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Colorimetric Measurement of Wines.

The color of red wines has always been deemed a matter of great importance by wine-makers, not so much because of any essential inherent benefit to the quality of the wine, but because of a time-honored demand for certain tints as characteristic of certain preferred brands of wine. The beauty of the ruby wine has been sung by poets on the one hand, and denounced as a device of the evil one to ensnare the unwary, on the other. On either hand, the importance of a beautiful tint in wine is admitted; and thus it becomes of practical importance to determine definitely both its kind and its amount or intensity.

In France, the country pre-eminently of red wines, the art of color-blending has developed hand in hand with that of producing definite qualities of wines, such as are demanded by customers year after year, from the annually variable product of the vineyards. There, the experienced purchaser of wines for blending purposes scrutinizes carefully not only the depth but also the particular tone of the wine color, in order to obtain from their intermixture just such products as his customers are accustomed to. There are certain commercial designations, both of tint and depth of color; but they are intelligible only to the expert, and vary from place to place, so that a unification of nomenclature was obviously necessary so soon as the greater facilities for communication brought these variable designations into contact with each other.

For some time nothing more definite than measurements of intensity were thought of, and these were usually made by the simple process of measuring how much water could be added to a deep-tinted wine before the tint became similar to that of a certain light-colored standard wine, or preferably some other solution. This method involved, however, an insuperable source of error in the varying tints of wines; it being impossible to judge definitely of *intensity* apart from the *tone* of two different colors, in which case no two observers would agree as to the exact point in question.

This difficulty led to the adoption by French manufacturers, of the color-scale devised by Chevreul, the distinguished French chemist. In this scale the variations of each primary color are designated by inter-combinations of their names for the general tints, while the minor variations are marked by numbers attached to these.

In the latest-improved instrument for this purpose (Salleron's vino-colorimeter), this color-scale is represented by 10 little silk disks, about three-fourths of an inch in diameter, placed in a row on a pasteboard strip. Alongside of these runs a row of similar disks of white silk, and the comparison is made by viewing these white silk surfaces through a layer of the wine to be examined, which, in making the observation, is made to appear exactly equal to some one of the colored silk disks, by means of a screw arrangement, which permits of making the layer of wine, placed between the eye and the white silk disks, of any required thickness, which can then be read off on a scale allowing of extremely accurate measurement.

Then, recording the name of the tint, and the thickness as measured by the scale on the containing cylinder, we have all the data needed for a permanent record of the exact color of the wine, the intensity of which is, of course, inversely proportionate to the thickness of the wine-layer that has furnished the same shade in the comparison.

In order to adapt these measurements to the current habit of using a decimal scale, most easily understood by all, such a scale may be formed by dividing the number of scale divisions read off in the observation, into one and the same constant number, which represents 100 times the lowest reading obtained, and which, of course, corresponds to the most intensely colored wine. Thus, the latter will be marked 100, as the highest of the intensity scale, while all others will fall below and their intensity will be expressed in percentages of the maximum.

The lowest reading of the scale found in this year's wines was .47 millimeter, or about the fifty-third part of an inch, in the case of the Gros Verdot, immediately after pressing. As this is a season of deficient color, it was thought best to make an allowance for a still deeper tint and to take .4 millimeter as the reading corresponding to the maximum of color in a wine, so as to make all ordinary tints fall considerably below 100 in the percentage expression, of which the figures of course express the relative depths of tint of the several wines. We find that when thus scaled, few wines range in color intensity above 50 per cent of the maximum. One of the most important uses of this instrument—Salleron's vino-colorimeter—will be in following the changes of color that our wines undergo in the process of maturing. Some, as for example the Grenache, lose color rapidly when left to themselves, unblended. It is asserted that certain blends prevent this loss of color, not only im-

parting their own tint but preventing the deposition of that of the Grenache itself in the sediments. It will be important to determine the correctness of this idea and the kinds of wines that will prevent the loss of color, if this can be done. Again, it will be of great importance to ascertain the effect of various modes of fermentation upon the tone, depth and permanency of red wines. It is asserted by some that hot fermentation tends to ultimate loss of color, while that at low temperatures tends to maintain the original tint. It is quite certain that, according to the method of fermentation used, the extraction of the pomace and the consequent tint of the wine may seriously differ. All these questions, heretofore dependent mainly upon individual estimates liable to error, can be answered with perfect definiteness by the use of this instrument.

Again, when it is desired to plant or graft a vineyard with a view to making up a deficiency of color in other desirable varieties, it is of no little importance to have a definite measure of the aggregate amount of coloration that can be expected from a given number of vines of a certain variety. In connection with the bearing qualities of the vines under consideration, this will form a perfectly definite guide to the proper selection.

Decrease of Color after Fermentation.

The subjoined table shows in a striking manner the changes which the colors of a number of wines, that have been observed at different times, have undergone in the course of after-fermentation. The first column of this table shows the intensity and tints observed immediately after pressing, according to the scale above explained. The second column shows the number of days that have elapsed between the two readings of the colorimeter. Were these figures the same throughout, or had the readings been repeated at regular intervals (as it is intended to do hereafter), the next column would at once indicate the relative proportion of loss of color in the several wines. As it is, it becomes necessary to divide out the loss among the days of the interval, and here again we are met by the objection that the loss of color is manifestly greatest at first, and gradually decreases until it becomes too slow to note at short intervals. For the present, however, we can do no better, and therefore give in the fifth column the average daily loss during the period of observation, while the fourth column gives the percentage of the decrease, referring it to the original intensity taken at 100. The sixth column gives the designation of the tints observed, according to Chevreul's scale, which ascends through six shades of purple-red toward red; which then shades off toward orange in four shades.

The following table shows the loss in color in red wines from the time of pressing until Nov. 20, 1886:

No.	Variety.	Grower.	Place of Production.	Original per cent of Color	Days bet. Observat's.	Observed Decrease.	Per cent of Loss.	Average Loss per Day	Name of Tint.
533	Pfeffer's Cabernet.......	Wm. Pfeffer............	Gubserville............	12	26	....	....	....	1st red.
527	Pfeffer's Cabernet.......	C. Weller..............	Warm Springs, Ala'da Co.	16.3	31	6.4	39.2	1.26	1st red.
552	Cabernet Franc.........	J. T. Doyle (Univ. plot.)	Cupertino............	34.8	19	....	....	....	3d purple-red.
514	Cabernet Sauvignon.....	Wm. Pfeffer...........	Gubserville............	58.8	36	20.4	34.6	.96	1st purple-red.
551	Gros Verdot.........	J. T. Doyle (Univ. plot.)	Cupertino............	85.3	17	13.9	16.3	.95	2d purple-red.
534	Tannat.................	Wm. Pfeffer............	Gubserville............	51.4	28	7.7	14.9	.53	2d-3d p'ple-r'd
520	Meunier............	J. T. Doyle (Univ. plot.)	Cupertino............	15.1	36	7.6	50.3	1.39	1st red.
516	Grossblaue.............	J. T. Doyle (Univ. plot.)	Cupertino............	40.8	37	5.1	12.4	33	1st purple-red.
545	Grossblaue.............	J. T. Doyle (Univ. plot.)	Cupertino............	57.1	19	17.5	30.7	1.50	2d purple-red.
499	Ploussard..............	J. T. Doyle (Univ. plot.)	Cupertino............	5.9	45	.1	1.7	.03	3d red.
541	Burgundy.............	J. S. Fowler........	Patchen..............	10.5	25	....	....	....	3d red.
524	Crabb's Black Burgundy.	J. T. Doyle (Univ. plot.)	Cupertino............	45.4	36	3.3	.72	.02	1st purple-red.
519	Pinot St. George........	J. T. Doyle (Univ. plot.)	Cupertino............	12.6	37	3.4	26.9	.73	3d red.
528	Charbono...............	H. P. Gregory..........	Soquel................	45.9	26	2.9	6.3	.24	1st purple-red.
537	Charbono...............	D. C. Feely............	Patchen..............	33.6	24	3.5	10 4	.43	2d purple-red.
529	Zinfandel..............	H. P. Gregory..........	Soquel................	48.8	26	16.3	33.2	1.29	2d purple-red.
536	Zinfandel..............	Mr. Sauffrignon.........	Patchen..............	12	24	....	....	....	5th purple-red.
498	Sirah..................	J. T. Doyle (Univ. plot)	Cupertino............	46.5	45	10.1	21.7	.45	1st purple-red.
532	Mondeuse...............	Wm. Pfeffer............	Gubserville............	39.2	28	2.6	6.6	.24	2d purple-red.
517	Barbera................	J. T. Doyle (Univ. plot.)	Cupertino............	57.1	47	21.4	37.5	.80	2d purple-red.
507	Gamay Teinturier	J. T. Doyle (Univ. plot.)	Cupertino............	54	45	.7	1.3	.03	2d purple-red.
492	Teinturier.............	J. T. Doyle (Univ. plot.)	Cupertino............	44.4	50	....	....	....	2d purple-red.
523	Fresa..................	J. T. Doyle (Univ. plot.)	Cupertino............	48 6	37	15.8	32.5	.87	1st purple-red.

Imperfect as this table is in its present form, it gives some very striking information. Thus, the Meunier from Cupertino shows the greatest loss of color, 50.3 for the whole time since pressing and the next to the highest daily loss, viz., 1.4 per day. This is the more remarkable, as in this case the original intensity was quite low, viz., 15.1. In most other cases of low color the loss is very slight, even where, as in the case of the Ploussard, the time between the readings has been very long. The deepest color of all was

shown by the Verdot, which during the first 17 days lost 16 per cent of the original color; but since that time has during 20 days lost nothing. During the first 19 days the Grossblaue lost over 30 per cent, while the Cabernet Franc remained almost stationary, as did also the Charbono, of Gregory, during 26 days; while the Teinturiers, in respectively 45 and 50 days, lost practically nothing at all of their color. The latter, evidently, have been prized not so much for the intensity (45 per cent) as for the permanence of their color.

The Zinfandels do not appear to advantage in this table, having lost color at the rate of about 1.3 per day, during the four weeks, so that one lost fully one-third of its initial color in that time.

A singular difference appears in the case of the Cabernets. In the Cabernet Franc, as above noted, the color remained stationary during 19 days; the Cabernet Sauvignon in twice that time lost 35 per cent, though still remaining slightly above the former in color; while Pfeffer's Cabernet from Warm Springs, with only 16 initial color, lost 39 per cent of it at the rate of nearly 1¼ per cent per day, in 31 days. Singularly enough, the same grape from Pfeffer himself, with a lower initial tint, lost nothing at all in 26 days. Such marked discrepancies in one and the same grape variety are well worthy of investigation, as they may lead to a better understanding of the causes of loss of color in general. Perhaps a clue to this point may be found in the comparison of the two batches of Grossblaue from Cupertino, of which one lost in 37 days only 12.5 per cent, or at the rate of one-third per cent a day; while the more mature sample, starting out at a much higher intensity, lost 30.6 per cent, or at the rate of 1.6 per day, being the maximum loss shown in the table, for that interval or any other on record. Whether the two will ultimately stop at the same point remains to be seen; for the present, attention may be called to the difference in their composition, which is essentially, for the earlier sample, a higher proportion of acid and less of tannin. That acid serves to maintain the color, has been alleged; but the present instance seems to furnish a striking proof of the fact, since the two differ but little in their alcoholic contents.

Many other deductions which might be made from the data in the table are omitted for the sake of brevity. The subject will be found more fully discussed in the forthcoming report of viticultural work for 1886.

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